

Exhibit H

TTY Forum

Seeking Solutions to TTY/TDD Through Wireless Digital Systems TTY/TDD FORUM - 10

DRAFT .01

(January 26, 1999)

**January 26-27, 1998
Gallaudet University
Washington, DC**

3. REVIEW & APPROVE AGENDA

Agenda accepted as presented. Agenda approved.

4. REVIEW & APPROVE TTY FORUM – 9 SUMMARY

Meeting summary for TTY Forum-9 approved.

5. TTY LIAISON REPORTS: FCC, CTIA/PCIA

FCC representative, Marty Liebman, stated that the FCC has received over 100 requests for waivers and is reviewing them and does not know when responses will be available. Andy Firth, a new representative from the FCC to the TTY Forum was introduced and stated that he looks forward to working with the group.

NAD, TDI did not have reports at this time.

CTIA, Andrea Williams, presented the CTIA summary of the FCC TTY waiver. The order provided carriers with procedures for presenting their requests for waivers. The order is silent with respect to confidential treatment but CTIA's understanding from Elizabeth Lisle is that the FCC rules regarding business confidentiality will be in force. The FCC concluded that additional time is necessary to thoroughly review the petitions and that waivers granted may be extended subject to conditions the FCC believes are appropriate. Erratum issued subsequently to correct and produce a list of all carriers under a temporary waiver. Marty Liebman, FCC, clarified that all judgements on final waivers are on hold until the petitions are fully reviewed.

CTIA has submitted the agreed to Standards Requirements Document (SRD) for IWF functionality to TR45 as well as the Consumer Requirements Document. Additionally the technical description of the 2.5 mm jack was submitted to the chair of TR45 and was remanded by the chair to various sub-committees for their

8. VOICE BASED SOLUTION (Formerly "Short-Term")

Analog Testing

Steve Mead, Lober & Walsh, presented the results of the development testing for with Motorola, CTIA, and Norm Williams, Gallaudet, participating. The post-test oversight is that the intelli-modem was doing line wrap that was not considered and this slightly over-stated the error of the intelli-modem. This established the analog base of under 1% error rate under ideal situations. There was a physical connection between the base station and the handset. The handset used was a MicroTAC lite. Ron Schultz believes that by reducing the text to under 65 characters it would be possible to eliminate the error.

Note: AT&T labs are now fully equipped for testing and offer the opportunity to all handset manufacturers to replicate testing. Contact Laura Ruby for scheduling.

TDMA Testing

Steve Coston, Ericsson, presented contribution #8, the preliminary results of the TTY compatibility measurements. The measurements will compare what measurements showed in November with results available today. Current testing is done with a modified acoustic coupling using a controlled lab environment. The phone is not moved while sending or receiving communications and is set optimally. This maintains signal strength etc. Ericsson used the Lober & Walsh test script. Note: DAMPS will be referred to as TDMA for rest of presentation.

Question from Norm Williams, Is this a quiet environment? For example, printing on the TTY would introduce noise. Answer: Printing wouldn't be part of these test and the environment would be quiet. AMPS showed lower than 1% error rate on all except low power downlink which was between 2.9 and 5.18.

TDMA showed higher than 1% error rate on both uplink and downlink at high power. Ericsson was unable to establish a call at low power.

GSM tests showed under 1% error rates at medium power both quiet lab and commercial network with moderate bumblebee. When testing included low power testing on commercial network with moderate bumblebee, 1 handoff and 0%-4% BER, the percent error increased to between 3%-9% error.

Conclusions drawn by Ericsson include the observation that direct connection provides only moderate improvement in the Lab environment. Analog and GSM performed well under Lab conditions. Under simulated conditions, minimal variables introduced impacted CER by an increase of 10x. TCER AND PCER vs. power level do not appear to be the most useful metrics for comparing system performance.

Questions:

Are you going to be moving forward with the acoustic coupler? Answer: The tests will be ongoing at Ericsson to determine that.

What is the impact of driving noise etc on the acoustic coupler? Answer: Testing will be ongoing and will be shared in the future.

CDMA Testing:

Kevin Klinesmith, Primeco, worked with UltraTEC in Madison, Wisc. Results are comparable to results seen previously. Primeco is working with 3COM to get V.18 modems for testing.

Ted Holdahl, Sprint PCS, discussed contribution #6, test results from Sprint PCS.

Testing began with UltraTEC equipment which was modified to break out audio and a Samsung handset and a Nokia handset. A Sprint and Nokia technician were working on the project. Sprint used a 5 cell test network with drive testing.

All results were similar to the Lab results which were unacceptable. The UltraTEC terminal could handle a 30 db range without degradation of performance. Closed Loop Power Control with CDMA is a function of the system which negotiates a 1% frame error rate which translates to an 8% character error rate rendering this error unacceptable. These tests validate that CDMA using the

vocoder process will yield a character error rate above 10%. The CDG view that the short term solution will be unfruitful for CDMA is therefore proven.

Steven Benno, Lucent, member of the speech and audio processing section of Lucent which develops the vocoders used in the networks, presented an alternative solution. Steven focused on CDMA because of the concern that CDMA was having the worst problem performing through the vocoder. Coming up with a new vocoder was not cost effective. The solution needed to be non-invasive to the vocoder to avoid impacting existing equipment. The solution would support VCO/HCO and be available in the near term. Challenges unique to CDMA were the noise suppression features that would cancel out TTY signals like it was noise.

Audio path solutions include a receiver/repeater from Phillips but forces encoder to full rate and turn off noise suppression, modify decoder beyond what is allowed by standards and the FER 2% would yield CER of 2.5%. This solution is attractive because it is a decoder only solution and be able to receive unmodified signals. Lucent attempted to improve and arrived at the "No Gain Solution" which brings the CER down to 0%. The solution is interoperable, supports VCO/HCO but requires modifications to the encoder and decoder.

The No Gain Solution applies to TDMA, CDMA, GSM, iDEN. The concept relates to turning down the adaptive code book because it is designed for speech and hinders TTY recognition. EVRC was used as a test because it uses only 7 bits vs. 20+ for others. Since baudot is so slow it takes eight frames in the vocoder, the process changes the code to send each character eight times and corrects if it is missing any letter. It is a completely passive system because both phone and network recognize the TTY tones. Any modified packet that goes to an unmodified decoder would hear the TTY tones. It is just a software upgrade to the encoder, decoder and would apply to any coder.

Questions:

Will it require a lot of effort to upgrade every base station and is that required?

Answer: No matter what you do for TTY every base station would have to be upgraded. This would require only a software upgrade.

Will there be a charge for this software? Answer: We have no problem providing the software for evaluation, but I know that Lucent has a patent and I do not know what financial provisions will be made.

Is there an increase in software requirements? For example, will the handset run out of memory and be unable to implement the solution? This is a concern for Qualcomm. Answer: If the handset is 99% full there is a possible problem. Nikolai Leung, speaking for Qualcomm, stated that it is a concern and may require an extra chip.

Will this work in the field? Answer: I feel more comfortable about taking this out of the lab because it is more robust than the repeater solutions. Lucent will test from June to end of 1999 for CDMA and possibly more technologies.

Will this impact regular users? Answer: Providing there are enough MIPs to not impact then there will be no impact.

Did you research MIP requirement or is this minimal? Answer: It is very minimal in MIP requirements.

On the classifier, would you be standardizing? Answer: Yes, we work through standards for all technologies if there is interest.

Software controllable DSPs? Only Nokia and Motorola have that. Answer: There is nothing that says new phones could not be modified.

It is important to have the consumer involved. Answer: I agree and will make the C code available. Just send me an e-mail. I would like to gather the cards of anyone who could help us test this.

What TTY device did you use? The NXI, a TTY card inserted into a computer.

To clarify the 0% CER – do you mean that it is really the same as analog (under 1%)? Answer: No actually this solution provides actual 0% because you have 8 chances to correct transmission.

Have you tried working with turbo code? Answer: I am not familiar with Turbo-code. Note from chair – Turbo-code is a proprietary form of baudot. Turbo-code is virtually the same except that the handshake is different and the speed is much faster. Ron Schultz will work with Steve to give him information on Turbo-code.

Conclusion: This appears to be a good solution because it is passive so a wireless phone will operate like a wireline phone.

The sophistication of the CDMA phones is profound, there are over a million lines of code in the phones. The solution proposed by Lucent is elegant but it is not trivial. The belief that this solution would be available to the public in less than a year is very optimistic.

The solution doesn't need to be standardized to be implemented. But it would be optimal for all manufacturers to agree on the way the solution is implemented in each phone.

This solution has additional features like support for HCO/VCO that are not available in the data solution. Should we continue with the other possible solutions? Discussion: There are still some questions and implementation

issues such as phones that do not have programmable chips, so we should continue to pursue solutions that are possibly viable. We can't limit features so we want to make sure that we can provide ring and all the features available on wired phones. We are attempting to provide consumers with a number of choices not either/or solutions. When will we possibly see this solution commercially available? Lucent product cycles are 6 months which would put this product delivery at the end of the year. Primeco is very thankful to Lucent for an alternative because we were not planning to put data in our network so we had not seen a solution we had planned to fund.

What happens if TTY users roam from a vocoder based networks to IWF based network? The Forum has taken the stand that the analog air interface is the default.

The feasibility of switching between a vocoder and IWF is still problematical. But we cannot dismiss one solution over another because we assume that it cannot be done.

Dale Hatfield, FCC, stated that he is very encouraged to hear about the hopeful innovation that have been presented today and feels that we can all think about the new solution and check for issues that may come up. However, the news today is very encouraging and will be reported to the Chairman.

In reviewing the Appendix F document, add Steve Coston, Ericsson, to TDMA and GSM and Dr. Steve Besso, Lucent, is added to the CDMA list, and Laura Ruby, AT&T wireless is added to TDMA list.

iDEN, Motorola, presented the testing results from both the lab environment and field testing. Connected a Motorola iDEN phone via a 2.5 mm custom cable and tested uplink and downlink to a Mobility TTY. Error rate PCER for mobile to land transmission was from under 1% to over 5%. Land to mobile PCER rates were

upwards of 8% to almost 16%. Field and Lab testing made less impact on PCER than uplink or downlink transmission. The discrepancy in the comparison figures is not due to a testing error but due to an equipment factor.

9. REVIEW/UPDATE APPENDIX D *Test Completion Matrix*

Held for next meeting

10. DATA SOLUTION (Formerly "Long Term")

Held for next meeting

11. DISCUSS / AGREE TO AN ACCEPTABLE CER

Judy Harkins will provide a contribution from the consumers at the next TTY Forum to establish the acceptable CER as a target.

12. REVIEW APPENDIX G – Typical Operating Characteristics of TTY Devices

Ron Schultz discussed contribution #7, Appendix G, identifying that the document is meant to be a summary to provide typical characteristics. This document is a living document and will be updated and modified as information becomes available. This document will be attached to the TTY Forum report to the FCC. On page 35 delete the word "typical" from second column heading and a change of the table name to "Sensitivity" rather than "Receive Levels."

13. FORMAT FOR FCC FINAL TEST REPORT

Before the completion of testing, ensure that field trials with consumers have been held. Standardize terms and ensure that dissimilar units are mixed so that all units are tested under all circumstances. Even at the end of the formal relationship of the TTY Forum, a relationship should continue in order to share information and progress

ATTENDANCE

NAME	COMPANY	PHONE	FAX	E-MAIL
Baquis, David	SHHH	301-657-2248	301-913-9413	Dbaquis@shhh.org
Benno, Steve	Lucent Technologies	973-739-1210	973-386-2651	Benno@lucent.com
Brandt, Richard	Gallaudet University	908-735-6171	215-790-3208	Brandt@gallaudet.edu
Brannon, John	Southern LINC	205-257-7877	205-257-1879	Jwbranno@southernco.com
Burdett, Amos	Samsung	972-761-7113	972-669-1819	Aburdett@telecom.samsung.com
Campbell, Sean	PBW	925-227-4544	925-227-3195	Sfcamp@pacbellmobile.com
Coston, Steven	Ericsson	919-472-7527	919-472-6612	Steve.coston@ericsson.com
Crollick, Jeff	SCC	813-985-3581	813-985-3582	Jcrollick@sccx.com
Firth, Andy	FCC	202-418-1898		Afirth@fcc.gov
Green, Kendra	NEC America	972-518-5379	972-518-5380	Greenk@ccgakidt.nec.com
Hall, Ed	CTIA	202-785-0081	202-466-7239	ehall@ctia.org
Hall, Lynsie	Wallis & Assoc	410-489-2808	410-489-2806	lynsie@erols.com
Harkins, Judy	Gallaudet	202-651-5677	202-651-5476	Judy.harkins@gallaudet.edu
Hatfield, Dale	FCC/OET	202-418-2470	202-418-1944	Dhatfiel@fcc.gov
Holdahl, Ted	Sprint PCS	913-664-8400	913-664-8440	Holdahl@pcslab.com
Huntley, Jim	Lucent Technologies	973-386-4331	973-386-2651	Jmhuntley@lucent.com
Karimian, Mike	Panasonic	770-338-6246	770-338-6210	Mkarimian@panasonic.atlanta.com
Kelly-Frey, Brenda	State of MD MD Relay	410-767-5891		frey@dbm.state.md.us
Kleinsmith, Kevin	PrimeCo	817-258-1281	817-258-1805	Kkleinsm@primeco.com
Lantor, Todd	PCIA	703-939-0300	703-836-1608	lantort@pcia.com
Lawlon, Joe	Lucent	630-979-0133		Jlawlon@lucent.com
Lee, Peter	Ameriphone, Inc.	714-897-0808	714-897-4703	Peterl@ameriphone.com
Lee, Sang Yoon	Samsung	011-82-2-751-2893	011-82-2-751-2943	Y4ok@samsung.co.kr
Leung, Nikolai	Qualcomm Inc.	202-530-3927	202-833-2161	Nleung@qualcomm.com
Liebman, Marty	FCC	202-418-0633		Mliebman@fcc.gov
Lin, Douglas	PrimeCo	817-258-1290	817-258-1805	Dlin@primeco.com
Longhurst, Audrey	Motorola	954-723-3798		Cal004@email.mot.com
Lyle, Elizabeth	FCC			
Mead, Steve	Lober & Walsh	805-544-1089	805-544-2055	Steve@lweinc.com
Melcher, John	NENA/APCO	713-625-9911	713-864-9911	Jmelcher@911.org
Millin, Brian	FCC	202-418-7426		Bmillin@fcc.gov

Exhibit I

TTY Forum

Seeking Solutions to TTY/TDD Through Wireless Digital Systems TTY/TDD FORUM - 11

Final

(May 18, 1999)

**May 18, 1999
Gallaudet University
Washington, DC**

5. TTY LIAISON REPORTS: FCC, CTIA/PCIA

Andrea Williams, CTIA, reported that the FCC would not be taking action on the recent waivers because of the progress at the TTY Forum. Several solutions that have recently been presented are looking very promising and the FCC want to make decisions based on the results of the testing of these promising solutions.

Marty Liebman, FCC, stated that Andrea Williams reported the FCC progress accurately and that the FCC is looking forward to hearing the progress of testing.

Karen Strauss, NAD, shared information on the Section 508 rulings and said the information is available on the web and by contacting her at NAD.

Claude Stout, TDI, reported that TDI has no formal report but TDI looks forward to hearing about the test results.

The IWF SRD has been remanded to subtask groups within TR45 and is being worked. 2.5mm jack SRD was submitted March 3, 1999, to TR45. The Consumer Requirements document was submitted in December to TR45.

6. REVIEW CORRESPONDENCE

Discussion on contribution #4, the Memo sent from the co-chairs of the TTY Forum asked about the responses to the letter generated by Dick Brandt on behalf of the TTY Forum. The only response received to date is from 3COM. Dick Brandt committed to attempting to get more responses from other manufacturers.

Contribution #7 from Sendele Wireless, informing the Forum that they have a CDMA product. The letter states that the testing is being done in analog. The TTY Forum will communicate with Steve Sendele to see if this product is a possible digital solution.

Contribution #8 is a list of 9-1-1 manufacturers who have TTY capabilities.

7. VOICE BASED SOLUTIONS (Formerly "short term")

Contribution #11 presents AT&T test results moving the product from a static lab environment and moving to a more challenging environment. The results include introduction of movement, fading, etc. The tests show that the analog testing error rates are virtually zero in a lab environment. Analog error rates in the dynamic environment are no longer zero. The CDMA phone produced low error rates in a static environment. The results show that for analog phone transmissions that the CER is under 1%. For digital the error rates from 7-12% with even good signal conditions causing about 3% CER. Test results show that the existing ACELP vocoder does not meet consumer requirements for less than 1% CER.

Ameriphone (Contribution #12) has conducted static tests on 2.5 mm jack for CDMA and TDMA and included HCO/VCO consideration. CER was under 1% for all phones tested in analog mode. 7-10% CER was recorded for CDMA, 0-3% for TDMA phones. Tests were done using 45.45 BAUD protocol. VCO/HCO tests required using the relay so the unknown of what was transmitted from the operators typing made calculating error rate from the relay difficult.

Lucent Technologies, Contribution #13, presented a progress report on the audio path solution, called the No-Gain solution in the TTY Forum. By turning the gain down in the adaptive filter in the vocoder it is possible to improve the error rate. By turning the filter down to zero when TTY is detected it is possible to send the TTY bits seven times and use that as a form of correction. Initial tests show virtually zero CER using this method. Testing has been done on CDMA and TDMA and Lucent's tests have provided areas for improvement to add robustness. The solution is fully interoperable and provides for VCO/HCO

usability. The 13K vocoder provides acceptable CER on unmodified and interoperable phones and zero CER on modified phone. TIA/EIA 136-410 performed at about 2% or under for multiple levels of signals at various simulated rates of travel on unmodified and interoperable systems, and virtually zero for modified solutions. The schedule for standards work on this product is ambitious and reflects the pressure felt by Lucent to provide a product to the market. The standards process is important to provide the interoperability required to develop a widespread solution. Solution for CDMA is under development. TDMA is awaiting standards commitment before development is begun. Real-time simulations will occur in June. Resources are being secured outside the research group to accelerate lab testing. All tests results presented are simulation but TTY manufacturers have provided equipment for testing. The GSM vocoders are not being evaluated at present. GSM will be addressed next. It is possible that the work on TDMA and CDMA may port to the GSM vocoders.

Lucent provided a computer simulation of the no-gain solution.

Nokia presented their demonstration and discussed their contribution #14 test results. Nokia is committed to providing extensive tests to ensure that the solution is backward compatible, ubiquitous and international. There are similarities between the Nokia and Lucent proposals. A significant difference is bypassing the vocoder to use the TTY decoder. On receipt of the TTY signal the TTY encoder is used. This solution demands a delay of around 4 frames for the TTY/TDD transmission. The delay will vary, based on the system. HCO/VCO is supported. The change to the encoder adds a position value to the TTY information. The transmission consists of 2 bits which specify what type of signal is present after the specified position. The decoder contains an error correction algorithm and TTY signal generator. The Nokia proposal for TDMA (EFR) will be introduced to TR45.3.5, PCS 1900 will be introduced to TIA, TDMA half rate has been introduced to UWCC for evaluation. CDMA etc. will be pursued.

Benefits of Nokia Proposal A include codec independent operation with a small modification. There is tolerance to tone frequencies, operation with 2 bit duration, and the delay provides protection against lost frames. Nokia's Proposal B provides tolerance to phase change, a reconstructed TTY signal of less than 2 frames, and detector, encoder, and decoder operating as independently as possible. Nokia Proposal C concept is ready for TDMA and PCS1900. This proposal does not alter speech codec algorithm and can be used for any other cellular system. The actual testing and standards process will take many months and Nokia is working with the standards bodies currently.

Motorola presented the CDMA voice-based solution. The Motorola solution says that the baudot signal should not be handled by the vocoder but in the higher pre-filter and rate selection by a rate determination algorithm occurs to optimize the frame rate for the transmission. TTY tone detector identifies the presence of the unmodulated baudot signal and starts the TTY tone detector. The primary channel goes to null traffic and the secondary channel carries the TTY characters. A history is carried with each character to ensure that any character that is lost will be recovered with the next character as history. Up to one hundred character can be contained in the secondary channel, all carrying a sequence number to ensure sequential transmission and identify any lost characters. When speech is present it immediately cancels the null traffic signal to the vocoder and enables the speech to be transmitted. Secondary frame is sent once per character. Inter-operating is supported by this solution when standards provides a standard CDMA transport as the default. This solution is independent of the vocoder because the vocoder is either on or off. The solution is in the call processing when the service option is determined upon call setup. The TTY option is enabled all the time making the phone capable of accepting a TTY or voice call depending on how the call is set up. This solution is currently only applicable to CDMA. It is similar to DTMF signaling. This solution would have a possible year cycle for development.

ATTENDANCE

NAME	COMPANY	PHONE	FAX	E-MAIL
Baquis, David	SHHH	301-657-2248	301-913-9413	Dbaquis@shhh.org
Benno, Steven	Lucent	973-739-1210	973-386-2651	Benno@lucent.com
Blanken, Brad	CTIA	202-736-3636	202-466-7239	Bblanken@ctia.org
Brandt, Richard	Gallaudet University	908-735-6171	215-790-3208	Brandt@gallaudet.edu
Brannon, John	Southern LINC	205-257-7877	205-257-1879	JWBRANNO@Southernco.com
Broener, Mary	Motorola	202-371-6900	202-371-6900	Amb004@email.mot.com
Campbell, Sean	Pacific Bell Wireless	925-227-4544	925-227-3238	Sfcamp@pacbellmobile.com
Coston, Steven	Ericsson	919-472-7527	919-472-6612	Steve.coston@ericsson.com
Doherty, Tom	US West Wireless	303-255-6114	303-255-6158	Tpdoher@uwest.com
Dzumba, David	Nokia	972-894-4722	972-894-5885	David.dzumba@nmp.nokia.com
Fatini, Masoud	Nokia Mobile Phones	972-894-4940	972-894-4988	Masoud.fatini@nmp.nokia.com
Green, Kendra	NEC America	972-518-5379	972-518-5380	Greenk@ccgakidlnec.com
Hall, Lynsie	Wallis & Assoc	410-489-2808	410-489-2806	lynsie@erols.com
Harbin, Steve	SBC Tech	512-372-5812	512-372-5891	Steve-Harbin@tri.sbc.com
Harkins, Judy	Gallaudet	202-651-5677	202-651-5476	Judy.Harkins@gallaudet.edu
Hatfield, Dale	FCC	202-418-2470	202-418-1944	Dhatfiel@fcc.gov
Huang, Jun - Jie	Nokia Mobile Phones	972-894-4584	972-894-4988	Jun-jie.huang@nmp.nokia.com
Huntley, Jim	Lucent	973-386-4331	973-386-2651	Jmhuntley@lucent.com
Jansson, Frederick	Ericsson	+468-764-1221	+468-757-5550	Frederik.jansson@er.a.ericsson.com
Jones, Seth	Nextel	703-433-8316	703-433-8788	Seth.jones@nextel.com
Karimian, Mike	Panasonic	770-338-6246	770-338-6210	Mkarimian@panasonic.atlanta.com
Kelley, Scott	Motorola	847-523-0821	847-523-8274	Scott.kelley@motorola.com
Kelly-Frey, Brenda	State of MD MD Relay	410-767-5891	410-767-5842	frey@dbm.state.md.us
La Flamme, Claude	Nokia	819-821-2761	819-821-7937	
Lantor, Todd	PCIA	703-939-0300	703-836-1608	lantort@pcia.com
Lee, Peter	Ameriphone	714-897-0808	714-897-4703	Peterl@ameriphone.com
Leung, Nikolai	Qualcomm Inc.	202-530-3927	202-833-2161	Nleung@qualcomm.com
Liebman, Marty	FCC	202-418-0633	202-418-7247	Mliebman@fcc.gov

Longhurst, Audrey	Motorola	954-723-3798	954-723-4522	Cal004@email.mot.com
Lucas, Al	Motorola	561-739-2280	561-729-8545	Emkt03@email.mot.com
Lyle, Elizabeth	FCC	202-418-0600	202-418-0787	Elyle@fcc.gov
Morrison, Art	Bell South	404-249-4520	404-249-5347	Art_morrison@bscc.bls.com
	Cellular			
Montgomery, Bob	Nextel	703-433-8315	703-433-8788	Bob.Montgomery@nextel.com
Navin, Thomas	McDermott, Will & Emery	202-756-8093	202-756-8087	Tnavin@mwe.com
Neeley, Doug	Nokia	972-894-5782	972-894-5782	Doug.neeley@yahoo.com
Parker, Virginia	Qualcomm Inc.	619-658-4789	619-651-8962	vparker@qualcomm.com
Peltz-Strauss, Karen	NAD	301-587-7466	301-587-1234	kpstraus@aol.com
Ruby, Laura	AT&T Wireless	425-580-8354		Laura.ruby@attws.com
Schultz, Ron	Ultratec	608-238-5400	608-238-3008	Rschultz@ultratec.com
Sonnenstrahl, Al	CAN	301-770-7555 (TTY)	same	sonny@clark.net
Spann, Charles	Nortel Networks	972-684-1723	903-852-3827	Charles.spann@nortel.com
Stout, Charles L.	TDI	301-589-3006	301-589-3797	Tdiexdir@aol.com
Suprock, John	Motorola	847-632-5370		QA4884@email.mot.com
Thomas, Al	Bellsouth Cellular	404-713-0361	404-713-0361	Al.thomas@bscc.bls.com
Tucker-Kinney, Micaela	Nokia	972-740-4991	972-894-5885	Micaela.tucker-kinney@nokia.com
Warrel, Karl	Voice Stream	+1-425-444-0045		Karl@warrel.com
Wei, John	Nokia	972-894-5549		John.wei@nmp.nokia.com
Wells, Ken	Philips Con. Comm	732-878-8436	732-463-6868	Kwells@pcc.lucent.com
Whritenour, Lee	Bell Atlantic	908-306-6485	908-306-6489	lwhrite1@mobile.bain.com
	Mobile			
Williams, Andrea	CTIA	202-736-3215	202-785-8203	awilliams@ctia.org
Williams, Norman	Gallaudet University	202-651-5257	202-651-5476	nswilliams@gallaudet.edu
Wood, Chuck	U.S. Cellular	773-399-7090	773-399-4984	Cwood@cellular.uicc.com

Exhibit J

TTY Forum

Seeking Solutions to TTY/TDD Through Wireless Digital Systems

TTY/TDD FORUM - 12

Final

**September 9, 1999
Crystal City Marriott
Washington, DC**

4. REVIEW & APPROVE TTY FORUM – 11 SUMMARY

Contribution #2, an E-mail from Judy Harkins, Gallaudet, identified some clarifications she would like made to the Summary. She stated that she wanted to be sure that each presenter's summary was clear and represented what they said. After discussion, presenters agreed that their presentations should remain unchanged in the summary. The addition of Judy Harkins' offer to proceed with a proposal for standardizing the Baudot signal which will be prepared by Dick Brandt, consultant, was made to the New Business section.

5. TTY LIAISON REPORTS: FCC, CTIA/PCIA, NAD, TDI

Marty Lieberman, FCC, is looking forward to seeing the manufacturers begin to implement solutions.

Todd Lantor, PCIA, looks forward to discussion of solutions to be shared in the meeting.

Karen Strauss, noted that the FCC held a forum on 7-1-1 services and many people sitting around the table were in attendance. Karen offered more information to anyone who needs it. The FCC has reserved 7-1-1 as an access code for Relay Services nationwide.

Further information is also available on the FCC web site at www.FCC.gov/711.

6. TECHNICAL STANDARDS ACTIVITIES

Contribution #3 discussed the three recommendations from TR45.1 in response to the TTY Forum submission of an SRD (Standards Requirements Document).

Published standard (IS-789) addresses the signaling, interim standard 788 addresses the mechanical requirements for an audio connector. The 2.5 mm jack is well understood and the standards body proposes no standard at this time.

Ed Hall asked the TTY Forum if, in the reply to the TR45.1 correspondence, a request for a TSB (Technical Service Bulletin) is appropriate. Dick Brandt noted

Brad as soon as possible. Karen Straus stated that it is extremely important to have the information on availability provided to consumers. The co-chair proposed a sub-group chaired by Brad Blanken be formed to produce the template and link it on the CTIA website ASAP. Karen Straus would like to have hearing aid compatibility be included.

Todd Lantor, co-chair, asked if the FCC would make their web site available to provide the information. The FCC agreed that the web site could probably be made available.

7. VOICE BASED SOLUTIONS (Formerly "short term")

Marty Lieberman, FCC, stated that the FCC is pleased to see the progress in CDMA and the work being done in TDMA but noted that a focus is on the timeline for development and implementation for the consumer. He asked that handset and infrastructure manufacturers provide their thoughts on a timetable for implementation and provide that to the FCC sometime during the day.

Steven Benno, Lucent, presented Contribution # 16 which included a real-time demonstration in duplex. Lucent responded to customer needs, particularly Bell Atlantic Mobile, and has worked toward a solution and providing a cost

The solution provides an opportunity to send 8-10 repetitions of each character by using the encoder and bypassing the adaptive encoder. This solution is applicable across all technologies since all systems use the same encoder. It requires a software upgrade and support HCO/VCO. Standards work was done quickly and feature release for CDMA is December 15, 2000. The translation is free and is included in the annual maintenance and software upgrades. TDMA is a different story since Lucent and Nokia presented solutions in May, then Ericsson presented a solution in July, Nokia presented a second solution in August. A decision should be reached on solution choice in September. The

Rate) was under 1%. Since the decoder only solution required a modification to the decoder in the handset and base station the Lucent solution which provides modification to the encoder and decoder

8. REVIEW/UPDATE APPENDIX D *Test Completion Matrix*

Steve Coston, Ericsson, presented Contribution # 12 on Modem Tone Signaling and Implementation Considerations. TTY tones are detected at the front-end and converted to a digital signal and then converted into a higher bit rate to be transmitted over a voice channel that's better suited to carrying those signals.

The signaling description on the landline side is associated with the function of the switch. Transparent switching between speech and TTY enables HCO/VCO. There is no impact on the TTY equipment on the PTSN (PSAP) side. Question: Have you considered the cost impact on the handset side? Answer: I'd like to hold cost discussions off-line.

Jim Ragsdale, Ericsson, discussed the contribution process for modem signaling. By quantifying "as good as analog" the requirement for radio conditions was established as CER s/b <1% over operating range of 14 to 30dB C/N. The typical cell border C/N is in the 16-17 range. These are presented as tougher requirements than those of as good as analog. The solutions are better for having been through the competitive process. There are 4 modem solutions on the table for consideration in TR45.3

Ericsson proposes that the solution will be built into the connecting cable between the phone and TTY device. For new terminals it would be possible to build the solution into the box. The three implementation options will be closely associated with the switch. Because the function is associated with the switch there is no impact to the PSAP or TTY device. Question: Could you demonstrate this for us now? Answer: No, not today. As of tomorrow we will have executable code that any TR45 member could test in the switch. Question:

Are you modifying the tones through the vocoder? Answer: No, under optimum circumstances TTY passes just fine what we are doing is making the signal more robust (speeding them up). Question: What initiates the process? Answer:

There are two question there – 1. Where is the TTY detector? The TTY detector is monitoring real time the input and when it detects TTY tones it enacts the function. Speech is passed directly on through the vocoder. Question: Have you tested against different vocoders and what were the results? Answer: Could we hold off on that for a minute?

The biggest challenge to good transfer is fading. By introducing 180Hz fading the challenge is significant. Question: QualComm uses a variable rate vocoder.

Have you tested on these? Answer: We believe that there won't be a negative impact. Comment: Lucent found that it was important to turn off noise suppression and to lock the coder at full rate. Answer: We don't believe that that would be a problem because you would have a TTY tone detector anyway.

Question: Is contribution #6 a dead issue since it requires a modification to the TTY device. Answer: Yes, Contribution #13 supercedes contribution #6.

Benefits to the solution in contribution #13 are listed in the presentation document. Question: Who is going to manufacture the modem box and address the size of the box – large/small? Answer: The model that we are using is that the modem is built into the cable. Question: Is there a box on the cable or is it built into the cable? Answer: We are proposing that it will be built into the connection and will be transparent. Question: Will Ericsson build them?

Answer: Ericsson could build them or outsource them but we see that the cable is necessary to connect the TTY device to the phone. Question: Is there a battery required? Answer: We hope that it may be able to be solar powered.

Comment: As a consumer I am concerned because we didn't want ot have to have extra equipment to buy. Comment: The modem can eventually be built

into the phone. **Comment: Dale Hatfield, FCC, observed that there has to be a change to the switch since there has to be some identifier to mark the beginning of the TTY call.** Answer: The coding will be in the subscriber profile. Question:

Dale Hatfield then asked to understand the call flow when placed from a landline.

Answer: The MSID identifies the mobile station as TTY capable and the call will be routed through the function.

Question: Toni Dunn asked if the TTY user has to self-identify in a profile to get this service? Answer: The equipment will identify. Comment: Toni stated that this could be a barrier if a wireless phone belonging to a hearing person (not profiled for TTY) was used by a TTY user to make an emergency call using their TTY device would they be recognized?

Answer: The function detects the TTY signal. Question: One of the requirements for FCC is that carriers must carry TTY emergency calls over uninitialized phones. Under this scenario will these calls provide the solution?

Answer: You will get normal TTY over the air interface – i.e. regular TTY signals passed with no enhancement. Question: You clearly are showing a conversion process in the switch so how can you say that there is no impact to the network?

Answer: We will test without making major changes to the network (i.e. a mobile to mobile call).

Question: Why do we need the identification in the Mobile subscriber profile?

Answer: That's the way we route the TTY function on the landline side.

Question: If you profile someone as TTY compatible will there be any negative impact on voice? Answer: No that's built into the robustness of the function.

Question: Can a carrier profile all users as TTY users and would that have any negative impact? Answer: Yes, but that means that every call is routed through your TTY function. Question: How do calls get routed when they are initiated from the landline side? Answer: The switch would route any call to that MSID

through the TTY function. Comment: Karen Straus noted her concern for uninitialized phones and having to have a profile because there are needs under both 9-1-1 and 255 access that are concerns to consumers. Answer: There are a number of implementation opportunities that could be implemented. You could route all 9-1-1 calls through the TTY function. If you had a class of mobiles that didn't fit in the standard classification then you can assign more than one directory number to the same phone – one routed to the TTY one routed for voice. Comment: Ed Hall, co-chair, noted that non-initialized phones are a

challenge to all of the viable solutions. Comment: Judy Harkins, Gallaudet, notes that the purchasing extra equipment, like extra cabling, is a concern.

Doug Neeley, Nokia, presented Contribution #15 describing the Nokia solution.

Nokia introduced two proposals. The first proposal is the Codec ByPass which provides comparable results to the other manufacturers but adds a music detection feature and ensures HCO/VCO capability but requires hardware (chip) changes to the handset and the base station. This solution will require a cable to connect to the phone. The second proposal relates to changing software. Phase changes have been tested, music detection is available and the solution is HCO/VCO compatible. Nokia can flash program at a retailer to upgrade phones to TTY compatible and no changes to the codec are required. Could be implemented in six months.

The third solution is to make the solution part of the connection cable.

Question: This is addressed to Nokia, Lucent, Ericsson. What have you done about testing? It sounds like there is no actual product available.

Answer: We at Nokia use TTYs and computers instead of handsets. Ericsson doesn't think that's a valuable question because they use a fixed point code to simulate. Lucent has not used a handset yet because they use a fixed point simulation and establish the function as a standard. Only after a solution is standardized and proven through simulation will we test it in our system. We saw that live testing was a requirement but that's not necessarily feasible. As of tomorrow our code will be frozen and then all the manufacturers will test each other's solutions.

Question: Difference between solutions? Answer: First we were working with Ericsson and used a DSP chip in the cable. The second solution eliminates the additional DSP chip and replaces it with software. Question: Steve Benno, Lucent, noted that he only knew of two solutions from Nokia, this last one has not

been presented anywhere but here. Will everyone be given executables tomorrow for testing? No Answer.

9. DATA SOLUTION (FORMERLY "LONG TERM")

Contributions # 8 and #9 were presented by Brad Blanken, CTIA, as a courtesy to Telesta, a CTIA member company who could not send a representative. The interworking function resides in the network and currently is available to GSM.

Other air interfaces will be available shortly. This technology makes text-telephone conversations possible and has been tested live for more than a year in Europe. Question: There is nothing manufacturers must do - it is simply something that a carrier buys or leases? Answer: That's correct as we understand it but we can not speak to the pricing or business plan.

Question: How does roaming work? Could you make a roaming call using TTY?

Answer: Both demonstrations we have seen live have been using a phone in a roaming situation and coming from a wireline switch in Sweden. Follow-up: That's not my point. That phone has to be in a GSM network? Or does it work in analog also? Answer: I don't know the answer but that may be a good point. I don't know whether the system operates in analog. Ed Hall and Todd Lantor, co-chairs, noted that the circuit switched data is applicable to all CDPD switches.

That means this technology should work over analog. This technology supports our long term data requirements. Comment: Judy Harkin shared that she e-mailed a colleague in Sweden and was told that it worked very well for TTY in Sweden. It currently does not support HCO/VCO. It does not pass through the current on the line to allow the light to indicate voice on the line. They do provide a vibrating pen or vibrating phone to indicate incoming calls.

Ed Hall, CTIA, reported that 3Com has just come out with information on a product that may be very similar to the Telesta product. 3Com will send information and a presentation to the next TTY Forum.

ATTENDANCE 9/9/99

NAME	COMPANY	PHONE	E-MAIL
Blanken, Brad	CTIA	(202) 736-3636	Bblanken@ctia.org
Hall, Ed	CTIA	(202) 736-3656	Ehall@ctia.org
Ragsdale, Jim	Ericsson	(919) 472-7548	Ragsdale@rtp.ericsson.se
Costen, Steven	Ericsson	(919) 472-7527	Steve.costen@ericsson.com
Wood, Chuck	U.S. Cellular	(773) 399-7090	Cwood@uscellular.com
Hatfield, Dale	FCC	(202) 418-2470	Dhatfiel@fcc.gov
Liebman, Marty	FCC	(202) 418-0633	Mliebman@fcc.gov
Thandu, Balsu	SBC Technology	(512) 372-5807	Balsu@tri.sbc.com
Williams, Norman	Gallaudet University	(202) 651-5257	Norman.Williams@Gallaudet.edu
Gillespie, Daniel	Gallaudet University	(202) 651-5049	Daniel.Gillespie@Gallaudet.edu
House, James D.	TDI	(301) 589-3006	Tdiexdir@aol.com
Doherty, Tom	US West Wireless	(720) 947-1440	Tpdoher@uswest.com
Benno, Steven	Lucent Technologies	(973) 739-1210	Benno@lucent.com
Huntley, Jim	Lucent Technologies	(973) 386-4331	Jmhuntley@lucent.com
O'Keefe, Patricia	McDermott, Will & Emery	(202) 756-8123	Pokecfe@mwc.com
Asher, Nicole	Motorola	(954) 723-8244	ENA003@email.mot.com
Brooner, Mary	Motorola	(202) 371-6900	Mary.brooner@motorola.com
Weiss, Tom	Motorola	(847) 435-2574	Q11390@email.mot.com
Lucas, Al	Motorola	(561) 739-2280	Al.Lucas@motorola.com
Campbell, Sean	Pacific Bell	(510) 305-1757	Sfcamp@pacbellwireless.com
Patrick, Mike	Pacific Bell	(925) 227-3013	Mpatrick@pacbellwireless.com
Gum, Arnold	Qualcomm	(619) 651-5178	Agum@qualcomm.com
Ruby, Laura	AT & T Wireless	(425) 580-8354	Laura.ruby@attws.com
Strauss, Karen	National Assoc. of Deaf	(301) 587-7466	Strauss@nad.org
Peltz			
Bonner, Brye	Motorola	(847) 516-5920	Brye.bonner@mot.com
Green, Kendra	NEC America	(972) 518-5379	Greenk@cegate.dl.nec.com
Thomas, Al	BellSouth Cellular	(404) 847-2478	Al.Thomas@bscc.bls.com
Harkins, Judy	Gallaudet University	(202) 651-5257	Judy.Harkins@gallaudet.edu
Brandt, Dick	Gallaudet University	(908) 310-7945	Dbcom@att.net
Karimian, Mike	Panasonic	(770) 338-6246	Mkarimian@panasonic.atlanta.com
Manetta, Steven	Omnipoint	(973) 290-2567	Smanetta@omnipoint-pcs.com
Schultz, Ron	Ultratec	(608) 238-5400	Rschultz@ultratec.com
Whritenour, Lee	Bell Atlantic Mobile	(908) 306-6485	Whritle@BAM.com
Hall, Lynsie	CTIA/PCIA Consultant	(410) 489-9946	Lynsie@erols.com
Montgomery, Bob	Nextel	(703) 433-8315	Bob.Montgomery@nextel.com
Jones, Seth	Nextel	(703) 433-8316	Seth.Jones@nextel.com
Mazrui, Jamal	FCC	(202) 418-0069	Jmazrui@fcc.gov